Input, Output and Productivity Performance in Chinese Industry, 1949-2009
(& Progress of the CIP Database)

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Agenda

- Literature review – data problems focused (omitted)
- The methodological framework
- The main research problems highlighted
- Sources of the basic data
- Coverage and classification issues
- Reconciling industry level gross output and value added with national accounts
- Procedures in measuring quantity and composition of labor
- Procedures in measuring capital stock and capital service
- Results and outstanding issues (focusing on 1987-2009)
- How the work on industry is to be integrated with work on non-industrial sectors? (The progress of the CIP Database project.)

The methodological framework

- The methodological framework used in this work and in the CIP database exactly follows the growth accounting methodology that has been developed by Dale Jorgenson and associates as explained in Jorgenson, Gollop and Fraumeni (1987) and more recently in Jorgenson, Ho and Stiroh (2005), which is also used as the general framework in EU/KLEMS (O'Mahony and Timmer, 2009).
- It is based on PPF where the gross output of an industry *j* is a function of capital, labour, intermediate inputs and technology, indexed by time *T*, that is

$$Y_j = f_j(K_j, L_j, X_j, T)$$

- Under the assumptions of competitive factor markets, full input utilization, and constant returns to scale, the growth of output can be expressed as the cost-share weighted growth of inputs and technological change,

$$\Delta \ln Y_{jt} = \bar{v}_{jt}^{K} \Delta \ln K_{jt} + \bar{v}_{jt}^{L} \Delta \ln L_{jt} + \bar{v}_{jt}^{X} \Delta \ln X_{jt} + \Delta \ln A_{jt}^{Y}$$

The methodological framework…

- where $\bar{v}_{jt}^{K} = \frac{P_{jt}^{K} K_{jt}}{P_{jt}^{Y} Y_{jt}}$ $\bar{v}_{jt}^{L} = \frac{P_{jt}^{L} L_{jt}}{P_{jt}^{Y} Y_{jt}}$ $\bar{v}_{jt}^{X} = \frac{P_{jt}^{X} X_{jt}}{P_{jt}^{Y} Y_{jt}}$
- and $\bar{v}_{jt}^{K} + \bar{v}_{jt}^{L} + \bar{v}_{jt}^{X} = 1$
- The right-hand side of each equation indicates the proportion of output growth accounted for by growth in capital services, labour services, intermediate inputs, and technical change as measured by TFP, respectively. It is common to define each input, e.g. labor, as a Törnqvist quantity index of individual labour types as follows

$$\Delta \ln L_{jt} = \sum_{l} \overline{w}_{l,jt}^{L} \Delta \ln L_{l,jt}$$

- Similarly, for capital K and other inputs X, given as

$$\Delta \ln K_{jt} = \sum_{k} \overline{w}_{k,jt}^{K} \Delta \ln K_{k,jt} \quad \Delta \ln X_{jt} = \sum_{x} \overline{w}_{x,jt}^{X} \Delta \ln X_{x,jt}$$

The main research problems

- Output (GO, VA)
  - Reconcile the national accounts in MPS with those in SNA by industry in nominal terms
  - Reconcile the national accounts with the input-output tables (SNA only) by industry in nominal terms
  - Reconcile the industry level gross output (GO) and value added (VA) with those of the national accounts (very tricky coverage issues!)
  - Reconstruct GO and VA deflators (so far only GO deflators)
- Costs of inputs
  - Derive the nominal M by subtracting the nominal VA from the nominal GO reconstructed.
  - Compensation for capital is a residual derived by subtracting IOT-based compensation for labor from the nominal VA
  - Deflate the nominal M by the GO deflator (not yet able to use the double deflation approach)

The main research problems…

- Labor input
  - Reconstruct the employment accounts in natural numbers and convert the numbers into hours by industry
  - Construct benchmark employment matrices by types of labor based on demographic and educational attributes by industry
  - Then, construct exactly matching labor compensation matrices
- Capital input
  - Reconstruct the industry level investment series using official stock data in historical costs, adjusted for scrapings and coverage
  - Reconstruct the industry specific deflators and deflate the so-constructed investment flows by industry
  - Estimate industry-specific depreciation rate
  - Estimate the initial capital stock for 1950, reconciled with the national aggregate stock
  - Estimate the real capital stock by the PIM
  - Estimate internal (ex post) rate of returns and rental price of assets

Main sources of the data

- Output
  - All estimates under MPS (phased out since 1995) and SNA (began in 1993) in annual *China Statistical Yearbooks* (CSY), occasional official reports before the annuals, *China Input-Output Tables* (CIOT) since 1987 (with 5-year interval for a full table) and *China Historical National Accounts* Databases (1952-95; 1996-2002)
  - Industry level data prior to 1980 are based on internal annual reports in NBS archives; since 1980 based on *China Industrial Economy Statistical Yearbooks* (CIESY)
  - Industry level data are also available from the 2^{nd} (1985) and 3^{rd} (1995) China Industrial Censuses, and the 1^{st} (2004) and 2^{nd} (2008) National Economic Censuses
- Prices
  - Implicit GDP deflators based on the national accounts (CSY)
  - Implicit GMP and NMP deflators (MPS) with underlying segmented comparable price index (CPPI) (CSY and historical database)
  - CIESY industry or group level producer price indices (PPIs)

Main sources of the data…

- Employment
  - Numbers employment by industry are from annual CIESY and CLSY (*China Labor Statistical Yearbook*) for the period from 1985
  - Historical data for broader classification are from two official publications on labor and wage statistics for 1949-78 and 1978-85 (the so-called “Pink Book” and “Green Book”) plus information from earlier surveys (national archives)
  - Industry level data are also available from the 2nd (1985) and 3rd (1995) China Industrial Censuses, and the 1st (2004) and 2nd (2008) National Economic Censuses
  - Only occasional working hours surveys since 1990s but state sector-focused and no industry details, published in CLSY
- Labor compensation
  - Average wage and total wage bill by broad industry group are from CLSY, and wage and welfare payment with industry details from censuses; plus CIOT income accounts

Main sources of the data…

- Fixed capital investment and stock data
  - Data on "total investment in fixed asset" (TIFA) are available by industry or industry group from CSY and/or CFAISY (*China Fixed Asset Investment Statistical Yearbooks*)
  - Industry level data on "capital stock" are the official so-called "end-year original value of fixed assets" from annual CIESY as well as 1985 and 1995 industrial censuses and 2004 and 2008 economic censuses
  - The 1950/51 asset census and various reports by the state planning commission and other agencies (national archives)
- Prices of fixed capital investment
  - Official measure of price change of fixed capital investment is available from annual CSY
  - PPIs of investment goods industries (steel, building materials, and machinery) from annual CSY
  - Price data from Ministry of Finance asset survey for 1980-1997

Coverage

- Coverage has been a problematic issue at industry/sector level.
- The implementation of "size criteria" since 1996 in official statistics has caused more inconsistencies in addition to problems associated with earlier changes from (state) ownership to (township) administrative level criteria. (Political incentives also caused inconsistencies).
- For example, one of the major problems is that since 2004 the value added of the "above size" firms in the industrial sector (with annual sales of 5 ml yuan or above; changed to 20 ml since 2011) began exceeding the national industrial GDP, and by 2008 it became 10% higher than the latter, leaving 40 ml workers producing negatively…
- My procedures:
  - Take the "formal sector" in industry as an umbrella ignoring other criteria
  - Make sure that the rest ("informal") controlled by the national totals (IOT, national accounts)
  - Use economic/population censuses to adjust inconsistencies in output and employment
  - Due to severe inconsistency between TIFA and GFCF, TIFA is not used as control total

Classification

- The official data are available at one or two-digit level by different standards of industrial classifications introduced at different times (CSIC/1975, 1985, 1994 and 2002), causing severe inconsistencies over time especially prior to 1994.
- We in principle follow the CSIC/2002 to re-classify the industrial data into 39 mining, manufacturing and utility industries, which are further regrouped into 24 industries in this study.
- The basic data set allows a very close conversion to the KLEMS classification for the industrial sector of the economy.

Reconciliation of Various CSICs

Wu-Yue	1994 CISC		1985 CSIC		1972 CSIC	
Code[a]	Code	Industry	Code	Industry	Code	Industry
02	⇦07	Oil and natural gas extraction	⇦0900	Oil and natural gas extraction	⇦0401 ⇦0402 ⇦0403	Oil extraction Gas extraction Petroleum refinery
12	⇦25	Petroleum refinery and coking	⇦3400	Petroleum refinery		
			⇦3510 ⇦3520	Coking Coal gas	⇦0321 ⇦0322 ⇦0310	Coking Coal gas Coal mining
24[b]	⇦45	Coal gas				
01	⇦06	Coal mining	⇦0800	Coal mining		
…	…	…	…	…	…	
03	⇦08	Ferrous metal ore mining	⇦1000	Ferrous metal ore mining	⇦0111	Ferrous metal ore mining
	⇦09	Non-ferrous metal ore mining	⇦1100	Non-ferrous metal ore mining	⇦0121	Non-ferrous metal ore mining
16	⇦32	Ferrous metal smelting and pressing	⇦4800	Ferrous metal smelting and pressing	⇦0112	Ferrous metal smelting and pressing
	⇦33	Non-ferrous metal smelting and pressing	⇦4900	Non-ferrous metal smelting and pressing	⇦0122	Non-ferrous metal smelting and pressing

Procedures for constructing industry level GO and VA

- The data work follows a novel “ownership approach”, that is:
  1. More systematic and easily available SOE data are used as the “hard core” for the entire period since 1949
  2. Non-SOE data for enterprises at or above the “township level” prior to 1998 and the “designated size” since 1998 are used to define the main non-state industrial activities that have been closely monitored and controlled by the planning authorities
  3. Less systematic data for enterprises at the “village level” (below the township level) prior to 1998 and below the “designated size” since 1998 are used to define the border of the “formal sector” and
  4. …hence to construct the output for the outer layer of the economy. We argue that applying this “ownership approach” at the industry level gives a more plausible estimate of the industrial structure than simply using observed structures in allocating “residuals”.
- Note that the Maddison-Wu commodity-based adjustment to VA is not used here, i.e. the official total output is not challenged.

Procedures in measuring labor input

- “Control totals” in numbers employed
  - The objective of this work is to solve the severe structural break in 1990 based on Wu (2011a) with a careful examination of the relationship between annual employment statistics and population census for 1982, 1987 and 1990.
  - It is clear that if the 1982 census results were incorporated into the national totals the structural break could have been moved back to 1982. This break was caused by the fact that the official annual estimates did not take into account the activities emerged outside the labor planning and administration system as a result of policy change in the early 1970s that encouraged small, collective enterprises to employ surplus labor especially in rural areas.
  - The adjustment is conducted for the period 1970-1990 using a trend-deviation approach with 1982 as the mid-point to “anchor” the series (Wu, 2011a).
  - The additional numbers between the new and the original total employment is allocated to labor intensive industries and services, justified by census information on the industrial structure of the least skilled labor.

Procedures in measuring labor input…

- Converting numbers employed to hours worked
  - Given a rigid labor employment system and regulations on working hours by the nature of industry under central planning, an institution approach is used to (mechanically) convert numbers to hours up to 1992/93 when the system began to relax and the 1995 Labor Law allowed certain extra hours (9 additional hours per week to the 44 “institutional working hours”.)
  - The post-1992/93 adjustment by industry is based on various surveys (anecdotal) using the official working-hour data as the mean for the “formal” sector industries.
  - For labor intensive, export-oriented manufacturing industries, usually non-state, we allow for maximum of 53 hours or 3 hours more depending on individual industries.
  - Numbers and hours are so-constructed for 24 industries and 3 ownership types for 1949-2009 as the industry level “quantity control totals”.

Converting numbers to hours

	1949-1953	1954-1957	1958-1993	1994	1995-2005
State: A (the baseline)	54	48	48	44	40
B	54	48	42	38	34
B*	54	48	42 (-1992)	46 (1993)	46 (1994-)
C	54	48	36 (-1992)	40 (1993)	40 (1994-)

	1949-1953	1954-1984	1985-1992	1993-2005
"Township Layer" (all industrial sectors)	54	48	52	56

	1949-1957	1958-1959	1960-1984	1985-1992	1993-2005
"Outer Layer" (all industrial sectors)	31.2 (65% of 48)	48	31.2 (65% of 48)	38.4 (80% of 48)	48

- A, B, C refer to industries subject to different conditions…
- Results:

$$\mathbf{H}_{s+++ot}^{M}$$

Procedures in measuring labor input…

- Constructing benchmark and time series employment matrices by demographic and educational attributes for both numbers and hours
  - For each benchmark, a marginal matrix is first constructed using census and survey data, limited and low quality
  - This marginal matrix is used together with the marginal matrix in the time series control totals to estimate a full-dimension matrix following IFP procedures (similar to RAS)
  - all benchmark full-dimension matrices are used to interpolate a time series that uses the industry level “quantity control totals”.
- Constructing the matching compensation matrices
  - Time series for total labor compensation is constructed using payrolls and IOTs for industry and ownership types (payrolls only)
  - Average benchmark compensation for various labor types is estimated and used to generate time series of compensation
- The matrix =24 ind x 2 gen x 7 age x 5 edu

Labor Input Indexing (skipped)

- Labour input indexing should be discussed coherently with a production function aggregating the services provided by different types of labour and capital.
- The essential idea of constructing labour input index roots in the heterogeneity of labour in the sense that different types of labour have different marginal products (Denison, 1962; Jorgenson and Griliches, 1967).

$$Y_t = A_t f(L_t, K_{1t}, ..., K_{jt})$$

$$L_t = \phi(H_{1t}, ..., H_{nt})$$

Labor Input Indexing…

- Following Chinloy (1980) and Jorgenson, Gollop and Fraumeni (1987), if assuming efficient labour market and linear homogeneity of Φ, then we have:

$$\frac{\partial \ln L_t}{\partial t} = \sum_{i=1}^{n} s_{it} \frac{\partial \ln H_{it}}{\partial t}$$

- where s_{it} is the share of the *i*th type of labour in total labour compensation, which is equal to its logarithmic marginal output under the efficiency assumption

$$s_{it} = \frac{w_{it} H_{it}}{\sum_{i=1}^{n} w_{it} H_{it}} = \frac{\partial \ln \phi}{\partial \ln H_{it}}$$

Labor Input Indexing…

- In the above equation the hourly wage of the *i*th type of labour is w_{it} and its compensation is $w_{it}H_{it}$. The growth rate of labour input is a convex combination of growth rates of total hours for each type of labour, with compensation shares as weights.
- However, this also indicates that the necessary condition for producer equilibrium is given by equality between the share of the *i*th type of labour in the labour aggregate and the elasticity of the aggregate with respect to the *i*th type of labour.

Labor Input Indexing…

- Let total hours worked by all types of labour be $H_t = \sum_{i=1}^{n} H_{it}$ Then, the growth rate of H_t is the sum of the weighted growth rates of hours worked by each type of labour (eq.5)

$$\frac{\partial \ln H_t}{\partial t} = \sum_{i=1}^{n} b_{it} \frac{\partial \ln H_{it}}{\partial t}$$

- with $b_{it} = H_{it} / \sum_{i=1}^{n} H_{it}$ the weight of the *i*th labour type. Therefore, average labour quality per hour can be defined as labour input divided by hours worked: (eq.6, eq.7)

$$Q_t = L_t / H_t$$

$$\frac{\partial \ln Q_t}{\partial t} = \sum_{i=1}^{n} (s_{it} - b_{it}) \frac{\partial \ln H_{it}}{\partial t}$$

Labor Input Indexing…

- Now following Christensen, Jorgenson and Lau (1973), we specify the labour aggregate in the translog form: (eq.8)

$$\ln L_t = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln H_{it} + 1/2 \sum_{i=1}^{n} \sum_{j=1}^{n} \beta_{ij} \ln H_{it} \ln H_{jt}$$

- where α_0, α_i, $i = 1, \ldots, n$, and β_{ij}, $i, j = 1, \ldots, n$, are parameters and where $\beta_{ij}=\beta_{ji}$ to satisfy the required symmetry conditions. Under linear homogeneity, we have $\sum_{i=1}^{n} \alpha_i = 1$ and $\sum_{j=1}^{n} \beta_{ij} = 0, \quad i = 1, \ldots, n$
- With efficiency assumption, the share of the *i*th type of labour equals its logarithmic marginal product (eq.9) (s_{it} is as eq.4)

$$s_{it} = \alpha_i + \sum_{j=1}^{n} \beta_{ij} \ln H_{jt}$$

Labor Input Indexing…

- Equations (8) and (9) as well as the symmetry condition $\beta_{ij}=\beta_{ji}$ imply that the growth rate of the translog index of labour input l_t is: (eq.10)

$$l_t \equiv \Delta \ln L_t = \sum_{i=1}^{n} v_{it} \, \Delta \ln H_{it}$$

- Where $v_{it} = (s_{it} + s_{it-1})/2$
- From eq.6, we can have (eq.11)

$$q_t \equiv \Delta \ln Q_t = \Delta \ln L_t - \Delta \ln H_t = l_t - h_t$$

- Clearly, the growth rate of quality will be positive if hours worked by relatively high wage labour increase more rapidly than total hours worked. (may also implying increase in education and seniority.

Labor Input Indexing…

- The contribution of each attribute of labour to "quality" (or the composition effect) change can be decomposed into two types of effects: the main effect of the attribute and the interactive effects of the attribute with each of the rest attributes. The main effect of the *i*th attribute is defined as the difference between the growth rates of labour input due to the *i*th attribute and total hours worked, regardless the time (eq.12)

$$q_i = l_i - h$$

- In the case of $q_i > 0$, as noted in Jorgenson and Griliches (1967), labour input measured as total hours worked is biased downward and hence TFP is biased upward (!)

Labor Input Indexing…

- Suppose that there are two attributes of labour, *i* and *k*, as a proper subset from *n* factors, a first-order interactive effect is derived from the partial index growth rate l_{ik} for the two factors and the single factor indices l_i and l_k: (eq.13)

$$q_{ik} = (l_{ik} - h) - (l_i - h) - (l_k - h) = l_{ik} - h - q_i - q_k$$

- that is, the joint effect of *i* and *k* or (l_k-*h*) less the main effect of each. If there are only two factors, *i* and *k*, the growth rate of labour "quality" (composition effect) is defined as the summation of the main effects of two factors and their first-order interactive effect:

$$q = l_{ik} - h = q_i + q_k + q_{ik}$$

- As for labour input with *j* factors, *l =1…j*, interactive effects up to (*j* – 1)th order are obtainable following the same principle (Chinloy, 1980, p.111).

Procedures in measuring capital stock

- We begin with the official IFA (investment in fixed assets)…
- **IFA** does not follow the SNA concept of "fixed capital formation" (***I***): "…finished investment project … transferred from producers/constructors to users (investors) in a given period"
- The Chinese usage of this concept: ***IFA***=the "work load" of investment projects recorded by the planning authorities and ***N***="newly increased FA" from $\boldsymbol{IFA}_{t\text{-}i}$ in a given period of the past time (i = 0, 1, 2, … τ)

$$N_t = \sum_{i=0}^{\tau} \theta_{t-i} \cdot IFA_{t-i}$$

- Note that a large part of ***IFA*** cannot be put into production in the year of investment, and some of ***IFA*** may never meet production standards and completely wasted, thus, ***N*** is better than ***IFA***;
- But both ***IFA*** and ***N*** contain residential structures and by definition exclude investment below the official threshold, and both could be over-/under-reported. – Recall that at the aggregate level **TIFA** has become increasingly larger than **GFCF** in the past decade.

Procedures in measuring capital stock…

- Also, if using ***N*** to deriving (the standard) ***I***, one needs to adjust it for residential structures (η) and undercoverage (λ) (assuming no over-reporting):

$$I_t = N_t \frac{1-\eta_t}{1-\lambda_t}$$

- Problems? Not only little information on η and λ and no detailed industry breakdown, but also ***N*** in a much shorter series than ***IFA***.
- However, there are also data on "capital stocks", i.e. conceptually an accumulated ***N*** (not ***IFA***!), called end-year gross fixed assets or ***GFA***, collected through the same reporting system. It has a long series and much cleaner than ***IFA*** because it comes directly from firms' accounting books.

Procedures in measuring capital stock…

- Recall that the **gross** capital stock can be defined as:

$$K_t^G = \sum_{\tau=0}^{T} I_{t-\tau} - \sum_{\tau=0}^{T} S_{t-\tau}$$

- where ***S*** denotes scrapings; therefore, rearranging the equation, the current period investment should be:

$$I_t = K_t^G - K_{t-1}^G + S_t$$

- Thus, for the Chinese case, the investment flow can be re-constructed as:

$$I_{i,t} = (1-\eta_{i,t})(GFA_{i,t} - GFA_{i,t-1} + S_{i,t})$$

- The so-constructed ***I*** is used in the PIM exercise to estimate ***K***. However, ***GFA*** do not cover the firms outside the reporting system. The results have to be adjusted for “full coverage”.

Procedures in measuring capital stock…

- Estimation procedures…
  - Reclassify official fixed assets in historical cost according to the CSIC/2002 with gaps filled.
  - Construct gross investment series by taking the first difference from the year-end fixed assets series
  - Adjusted for scrapings by an assumed withdrawing function for different periods
  - Decompose the results into equipment, industrial and residential structures based on scattered information from MoF; then remove residential structures.
  - Initial stock is constructed based on China's 1951 asset census.
  - Construct price indices to deflate equipment and structures, using official data (MoF) on asset evaluation for SOEs.
  - Estimate depreciation rates based on the service lives of assets by type and by industry (regulations for 1963 and 1993) and the declining balance rates used by BEA (Hulten & Wykoff, 1981), assuming a geometric decay function.
  - Finally, adjustment for a full coverage.

Measuring capital service…

- How a capital asset is valued? Assuming that rental markets exist for capital assets of all vintages, the cost minimisation behaviour of producers implies that capital of each vintage will be rented up to the point that the value of its marginal product $\partial Q/\partial I$ is equal to its rental price P^K, which implies that

$$\Phi_s = \frac{\partial Q / \partial I_v}{\partial Q / \partial I_t} = \frac{P^K_{t,s}}{P^K_{t,0}}$$

- where s=t-v denoted asset age. With this relationship, we can then, following Hulten (1990), define the asset price P^I in terms of the relative efficiency sequence and the rental price of new assets:

$$P^I_{t,s} = \sum_{\tau=0}^{\infty} \frac{\Phi_{s+\tau} P^K_{t+\tau,0}}{(1+r)^{\tau+1}}$$

Measuring capital service…

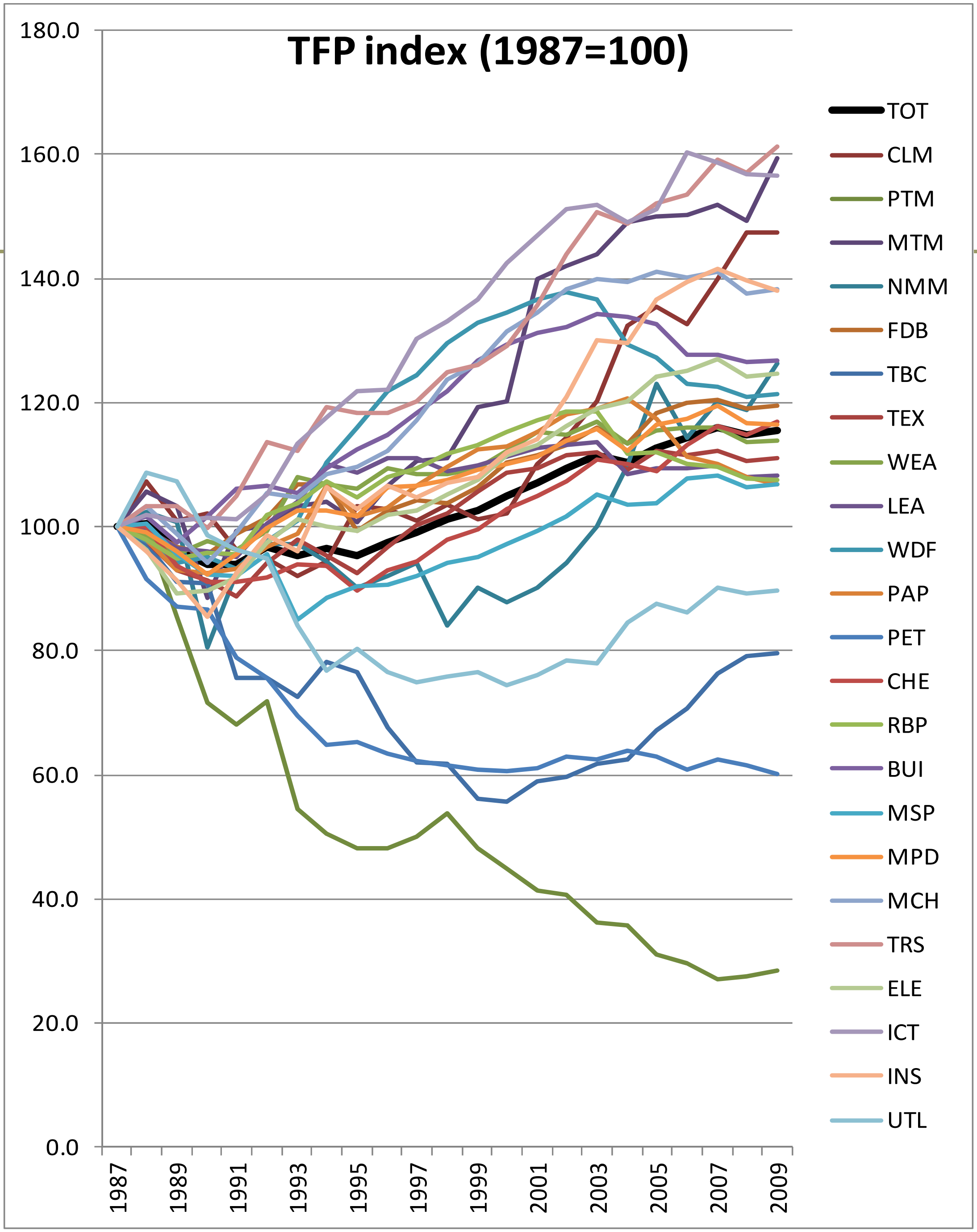
- Importantly, in the absence of rental markets, this expression is also valid for the case in which capital is utilised by its owner (Hulten, 1990, p.128). This can be seen clearly as
- $P^K_{t,s} = \left[r - \rho_{t,s} + (1+\rho_{t,s})\delta_{t,s}\right]P^I_{t,s}$ where $\rho_{t,s} = \frac{P^I_{t+1,s+1}}{P^I_{t,s+1}} - 1$
- Therefore, the above equation has a straightforward interpretation: when capital is used by its owner, the equilibrium value of the *implicit* rental must cover the real opportunity cost of an investment of value of as well as the loss in capital value as the capital asset ages (Jorgenson, 1963; Hall and Jorgenson, 1967).

Measuring capital service…

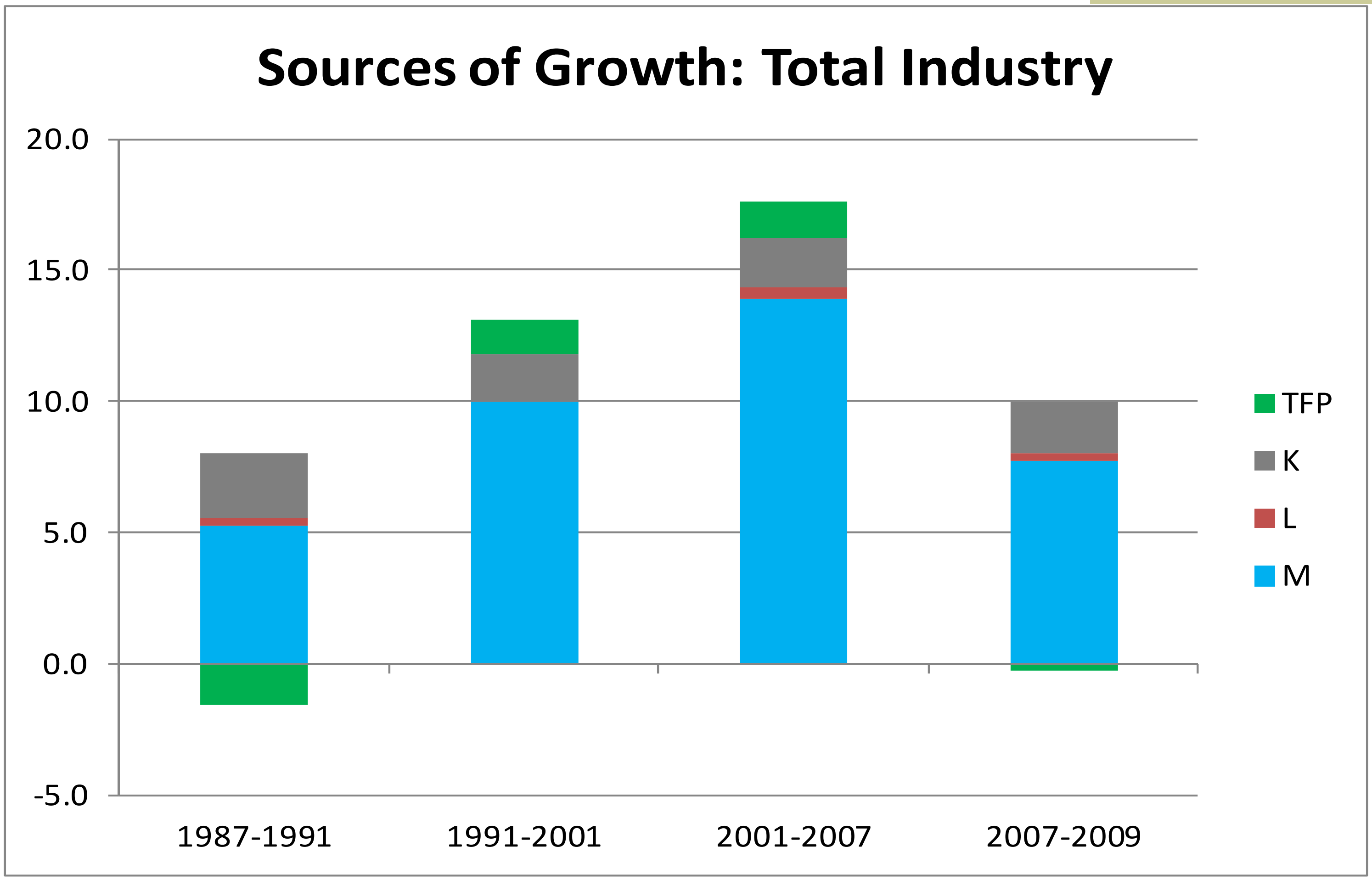
- As discussed in Jorgenson (1973), this equation can be rearranged to link economic depreciation to changes in asset efficiency:

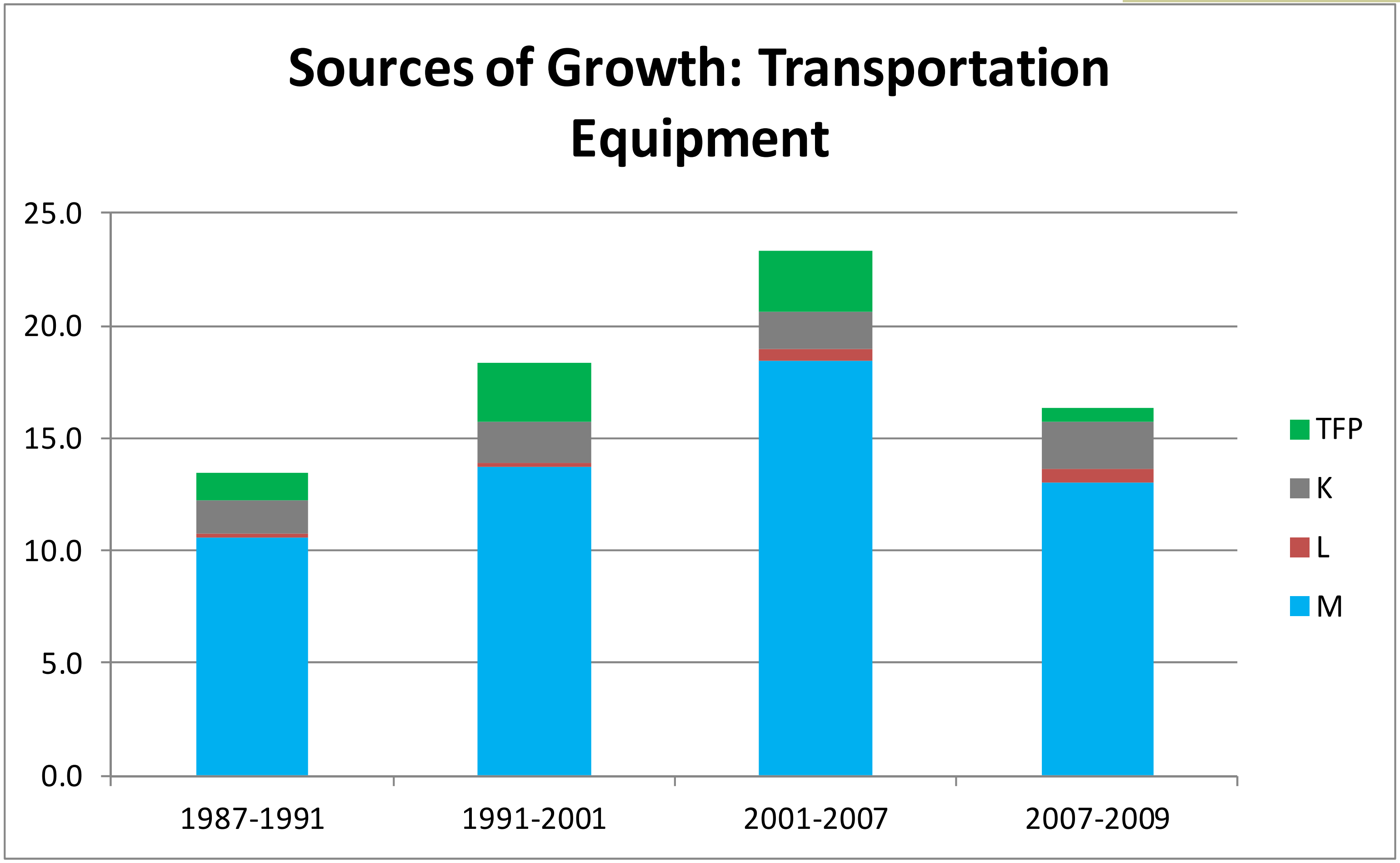
$$\delta_{t,s} P^I_{t,s} = P^I_{t,s} - P^I_{t,s+1} = \sum_{\tau=0}^{\infty} \frac{(\Phi_{s+\tau} - \Phi_{s+\tau+1}) P^K_{t+\tau,0}}{(1+r)^{\tau+1}}$$

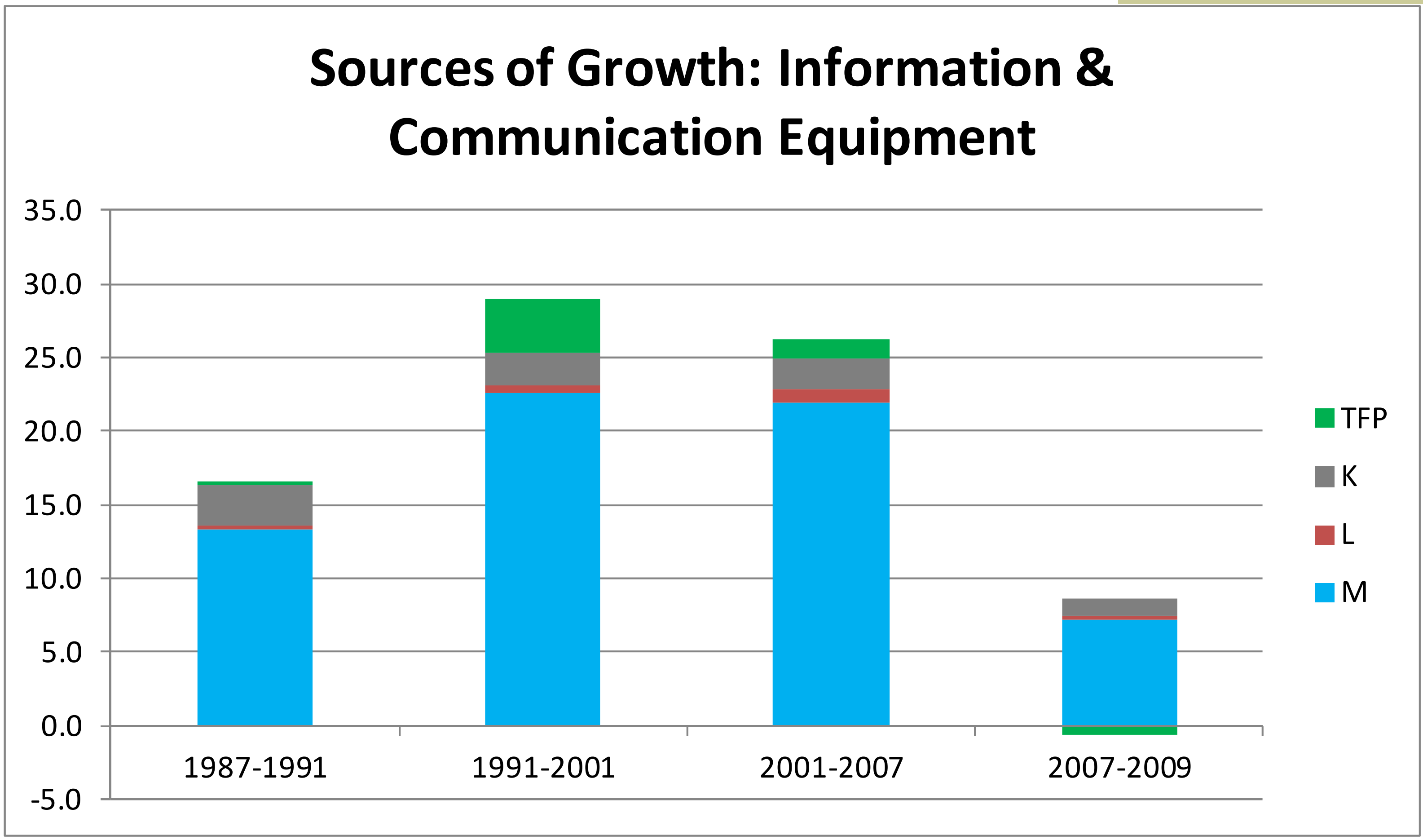
- which states clearly that Hicksian economic depreciation is the present value of the rental income loss due to the efficiency decay $\Phi_{s+\tau} - \Phi_{s+\tau+1}$ taking place in each year in the future (τ = 0, 1, 2, …).
- As emphasised by Hulten, this "shows that economic depreciation (a price effect) and efficiency decay (a quantity effect) are not independent concepts. One cannot select an efficiency pattern independently of the depreciation pattern and maintain the assumption of competitive equilibrium at the same time." More importantly, "this framework is useful for revealing what economic efficiency is, but it is also useful for revealing what it is *not*. Depreciation is not the replacement cost of the efficiency units used up in any year, because [it] is not generally equal to [the latter]… unless decay is geometric (1990, p.129)."



- ICT and transportation equipment industries were the fastest TFP growth industries in 1987-2009
- Oil extraction and petroleum industries experienced significant TFP decline


Sources of Growth: Total Industry
20.0
15.0
10.0
5.0
0.0
-5.0
1987-1991
1991-2001
2001-2007
2007-2009
TFP
K
L
M


Sources of Growth: Transportation Equipment
25.0
20.0
15.0
10.0
5.0
0.0
1987-1991
1991-2001
2001-2007
2007-2009
TFP
K
L
M



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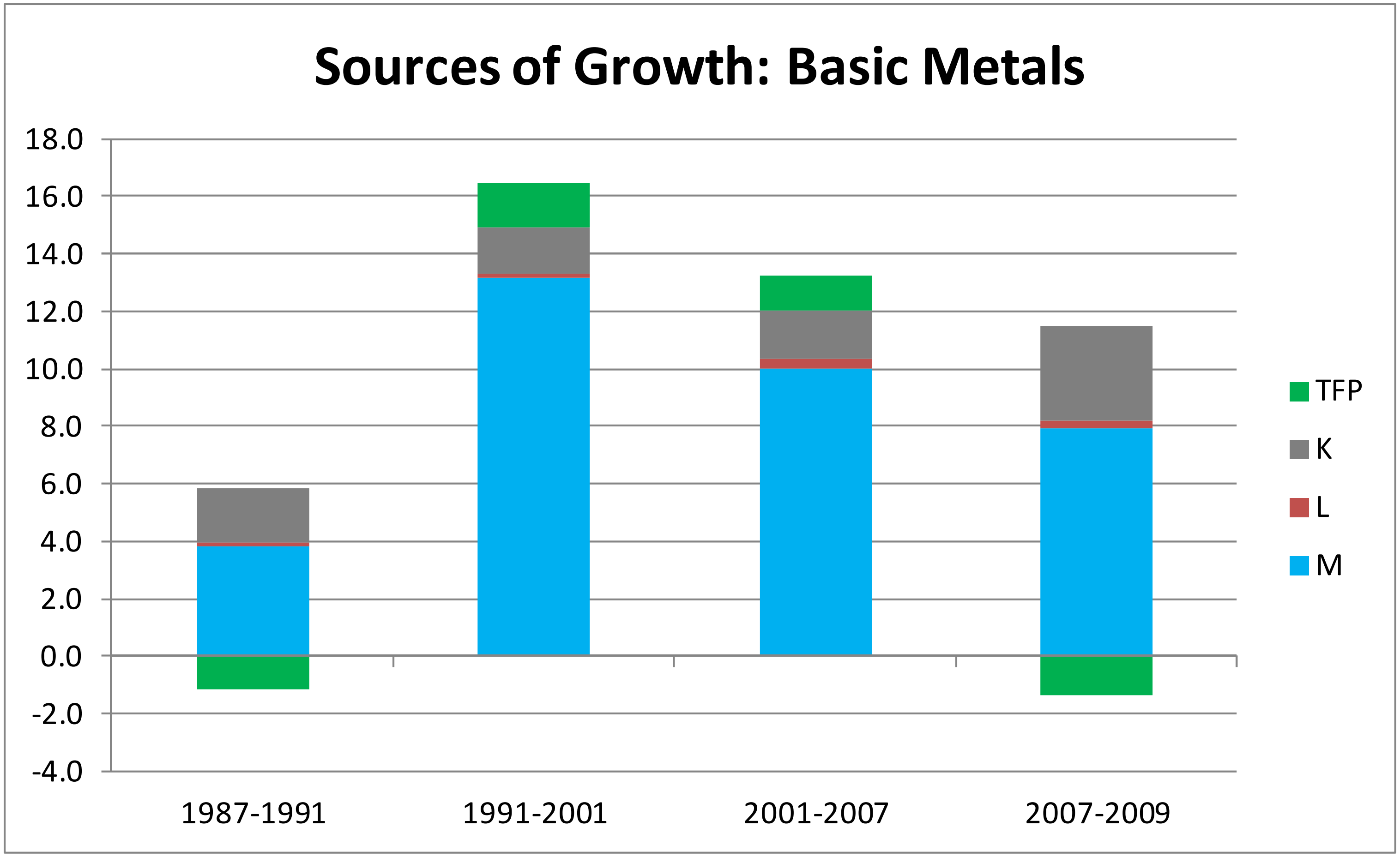

Sources of Growth: Basic Metals
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
1987-1991
1991-2001
2001-2007
2007-2009
TFP
K
L
M

Working on non-industrial sectors – progress of the CIP project and on-going work

- Progresses made
  - Quantity of employment (numbers and hours) for non-industrial sectors (agriculture, construction, plus 13-15 services – see classification chart)
  - GO and VA for non-industrial sectors (based on IOTs, controlled by the national accounts)
- On-going work
  - Labor input for non-industrial sectors (working on compensation matrices)
  - A new round of SUTRAS exercise to re-construct time series IOTs using improved price deflators
  - Reconciling fixed asset investment in non-industrial sectors with that of the industrial sector and GFCF

TT	Total Economy (1000 persons, mid-year)
AtB	Agriculture, Hunting, Forestry and Fishing
C	Mining and Quarrying
15t16	Food, Beverages and Tobacco
17t18	Textiles and Textile Products
19	Leather, Leather and Footwear
20	Wood and Products of Wood and Cork
21t22	Pulp, Paper, Paper , Printing and Publishing
23	Coke, Refined Petroleum and Nuclear Fuel
24	Chemicals and Chemical Products
25	Rubber and Plastics
26	Other Non-Metallic Mineral
27t28	Basic Metals and Fabricated Metal
29	Machinery, Nec (not elsewhere classified)
30t33	Electrical and Optical Equipment
34t35	Transport Equipment
36t37	Manufacturing, Nec; Recycling
E	Electricity, Gas and Water Supply
F	Construction
50t52	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel
H	Hotels and Restaurants
60	Inland Transport
61	Water Transport
62	Air Transport
63	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies
64	Post and Telecommunications
J	Financial Intermediation
70	Real Estate Activities
71t74	Renting of machinery & equipment and Other Business Activities
L	Public Admin and Defence; Compulsory Social Security
M	Education
N	Health and Social Work
O	Other Community, Social and Personal Services
P	Private Households with Employed Persons

Classification

- We in principle follow the KLEMS classification
- However, data availability forces us to adopt a short version of the KLEMS classification
- It satisfies comparison with other developing economies
- The classification in the table on the left may be further reduced when we construct capital input at a later stage